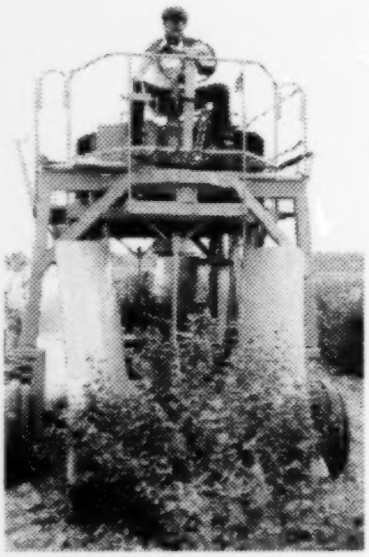
Agriculture and Food
Saskatchewan



## Strategic Research Programs

Last Update: July, 2000



The Strategic Research Program (SRP) is an umbrella agreement between Saskatchewan Agriculture and Food and the University of Saskatchewan. Under SRP, the Department provides funding to the University for defined research activity which is long-term and strategic in nature, maintains research capacity and provides industry support and services in those areas. The SRP is managed by the ADF Board of Directors and each SRP Program is directed by a Steering Committee which includes industry representatives. In addition to semi-annual reporting, each program is reviewed in detail every five years.

**University of Saskatchewan:**

- **AREA I** - Integrated Soil Management
  Program Leader: Darwin Anderson
- **AREA II** - Crop Development Centre
  Program Leader: Rick Holm, U of S
- **AREA III** - Animal Production
  Program Leader: Bernard Laarveld, U of S
- **AREA IV** - Agricultural Economics - Economic Linkages
  Program Leader: Murray Fulton, U of S
- **AREA V** - Native Fruit Development
  Program Leader: Richard St.Pierre, U of S
- **AREA VI** - Animal Biotechnology
  Program Leader: Bernard Laarveld, U of S
- **AREA VII** - Value-Added (Meats)
  Program Leader: Bob Tyler, U of S
- **AREA VIII** - Value-Added (Crops)
  Program Leader: Bob Tyler, U of S
- **AREA IX** - Agriculture and Bio-Process Engineering
  Program Leader: Shahab Sokhansanj, U of S
- **AREA X** - Food, Animal Behaviour and Welfare
  Program Leader: Joe Stookey, WCVM
- **AREA XI** - Animal Disease Diagnosis
  Program Leader: Ted Leighton, WCVM
- **AREA XII** - Reproduction Efficiency in Livestock
  Program Leader: Peter Flood, WCVM
- **AREA XIII** - Administration
  Program Leader: Michael Corcoran, U of S

**Prairie Swine Centre** Program Leader: John Patience

**Veterinary Infectious Diseases Organization (VIDO)** Program Leader: Lorne Babiuk

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**Research**

**Integrated Soil Management**

## Sub-Program 1.1.1

A Saskatchewan inoculant for chickpeas and bean, two promising new specialty crops.
Objectives are:

1. To develop inoculants for chickpeas and bean.
2. To determine the competitiveness and survival of the rhizobia.
3. To promote, manufacture and supply the new chickpea and bean inoculant to producers.

### Sub-Program 1.1.2

Nitrogen and phosphorus fertility requirements and rotation effects of chickpea.
Objectives are:

1. To determine the effects of N and P fertilization on agronomic traits of chickpea including n fixation, days to maturity, seed yield, seed protein content and N and P fertilizer use efficiency.
2. To develop N and P fertilizer recommendations for dryland chickpea.
3. To examine the consequences of including chickpea in a crop rotation, including effects on soil moisture availability, and N and non-N benefits conferred to subsequent crops.

### Sub-Program 1.1.3

Residual N benefit of pulse crop residues on succeeding crops.

### Sub-Program 1.1.4

Agronomic and economic assessment of variable rate fertilization.
Objectives are:

1. To determine the agronomic feasibility of variable rate fertilization using existing technology for variable rate fertilization.
2. To determine the economic benefits associated with variable rate fertilization.
3. To develop quarter section scale mapping tools required for the practical implementation of variable rate fertilization by farmers.

### Sub-Program 1.1.5

Placement and use efficiency of anhydrous ammonia.
Objectives are:

1. To quantify, at the landscape-scale, the availability and losses of banded or seed-placed anhydrous ammonia under minimum tillage management.
2. To determ the factors that control losses and the availability of N at the landscape-scale level.

3. To test management practices that will reduce N losses under minimum tillage.

**Sub-Program 1.2.1**

New approaches for assessing crop damage potential of soil residual herbicides.
Objectives are:
To develop and evaluate the 'Plant Root Simulator' for detecting the presence and potential plant toxicity of herbicide residues in soil, as an alternative to conventional, chemical-based extraction techniques for herbicides.

**Sub-Program 1.2.2**

Soil fertility and quality in conservation cropping systems.
Objectives are:
To develop management guidelines for optimizing fertility in soil - conserving crop rotation systems in Saskatchewan.

**Sub-Program 1.2.3**

Improved fertilizer management strategies.
Objectives are:
To identify nutrient limitations to crop production and develop appropriate fertilizer management strategies for Saskatchewan producers.

**Sub-Program 1.2.4**

Fertility management guidelines for value-added activities.
Objectives are:
To address soil fertility concerns in value-added agricultural initiatives in Saskatchewan: Intensive livestock production, biotechnology and horticulture.

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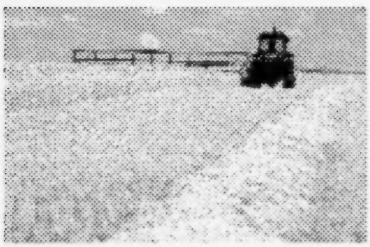
**Research**

**Crop Development Centre**



### Sub-Program D.2.1: Alternative and Specialty Crops

Lentil Breeding
Pea Breeding
Evaluation of Potential New Crops
Faba Bean Cultivar Evaluation
Flax Cultivar Evaluation

### Sub-Program D.2.2: Spring Wheat Development

1. Hard Red Spring Wheat Breeding
2. High Yield Wheat Breeding
3. Spring Wheat Disease Resistance Screening

### Sub-Program D.2.3: Barley and Oat

1. Oat Research and Cultivar Development
2. Non-malting Barley Research and Development

### Sub-Program D.2.4: Biotechnology, Genetics and Physiology of Grain Crops

1. Study of Abscisic Acid (ABA)
2. Stress Tolerance Genes
3. Seed Germination
4. Genetic Engineering of Flax: Particle Gun Transformation
5. Evaluation of Grain Legumes for Genetic Transformation
6. Environmental and Regulatory Aspects of Transgenic Crop Production

### Sub-Program D.2.5: Conservation Production Systems

1. Winter Cereal Breeding
2. Environmentally Friendly Production Systems
3. Economic evaluation of Production Systems
4. Assessment of Sustainability of Winter Wheat and Spring Wheat
5. Engineering Wheat Genotypes to Resist Stress
6. Weed Control

### Sub-Program D.2.6: Crop Utilization

1. Quality Evaluations in Alternate and Specialty Crops
2. Cooking Quality of Saskatchewan-Grown Lentils
3. Composition of Flaxseed and Flaxseed Meal
4. Quality Evaluation of Barley and Oats

5. Utilization and Value-Added Processing of Hull-less Barley

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**Research**

**Food Animal Production**

## Sub Program 3.1: Porcine plasma as a protector of newly-weaned pigs in harsh environments

Top quality creep and starter diets are now formulated with spray-dried porcine plasma. Such diets produce dramatic improvements in gain and health over soy-based formulations. Porcine plasma may be successful because of reduced dietary antigens, improved intake and amino-acid balance. The overall objective is to show whether dietary porcine plasma has a protective effect for pigs weaned into dirty, cold or other stressful environments.

### Sub program 3.2: Management practices for increased sow productivity

The fertility of the breeding herd is one of the most important factors affecting the profitability of swine production. even slight changes in reproductive efficiency can result in great changes in economic benefit or loss. Therefore, it is of vital interest to the Saskatchewan Swine industry that research be conducted towards increasing productivity.

**Activity 1:** Altered expression of tumor necrosis factor alpha (TNF-alpha) receptors in the uterus of estrogen-treated pregnant gilts
**Activity 2:**Effect of progesterone treatment on uterine expression of IGF-I mRNA
**Activity 3:**Growth hormone as an amplifier of insulin-like growth factor I action: Potentiated aromatose activity of cultured porcine granulosa cells

### Sub Program 3.3: Hormonal manipulation of animal productivity

The objective is to identify hormonal mechanisms controlling animal productive function which may be targeted through nutritional, genetic or other management techniques.

**Activity 1:**Improved gut development of neonatal pigs and lambs through stimulation of gut maturation through dietary and immunological means
**Activity 2:**Effect of feeding aspartic acid on somatotrophin and IGF-1 profiles in pigs

### Sub Program 3.4: Genetic selection of beef cattle

The objective is to identify DNA markers for economically important strains.

**Activity 1:**To identify major genes involve in milk production using the random approach of microsatellites and to a lesser extent, candidate genes.



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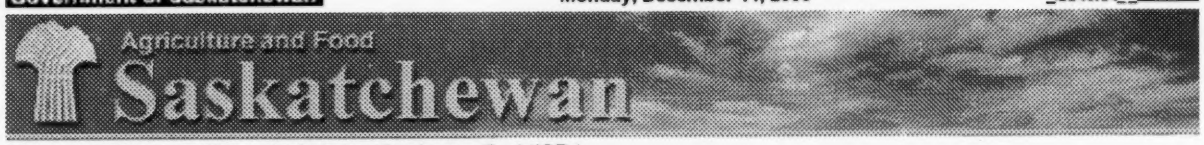




**Research**

**Economic Linkages**

## Sub-Program: Trade Linkages

The main objective of this sub-program is to evaluate existing trade agreements, and identify ways in which they might be modified to improve our trade linkages. As conventional trade barriers fall, this sub-program will help by (a) assessing the implications of the changing trade environment and developments in trade policy; and (b) assessing how Saskatchewan agriculture and food is responding to the changing trade environment.

### Sub-Program: Risk Management in Saskatchewan Agriculture

The primary goal of this sub-program is to maintain the competitiveness and sustainability of farms through the study of risk issues and the development of risk management tools. The research in this past year has examined three aspects of income stabilization: crop insurance, the effectiveness of NISA for the feeder beef sector and risk management in the beef sector.

### Sub-Program: Industrial Linkages to Expand On-farm Diversification and Value-Added Processing Opportunities

To ensure that the whole food supply chain in Saskatchewan remains responsive to the market demand for products and commodities, we must learn to understand changes and manage the production chain in the context of regulation, contracting, marketing, legislation, conservation practices, food processing and other value-added activities to ensure that increased levels of co-ordination and integration are maintained. This will allow individuals to understand the part they play in the whole system, and to understand, and interpret, market signals that are no longer communicated on price alone.

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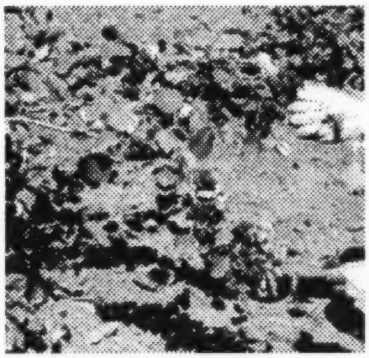
**Research**

**Native Fruit Development Program**



The Native Fruit Development Program addresses critical research needs for the development of the native berry industry including:

- new cultivar development and cultivar testing
- research and development into improved production practices
- application of new production technology and practices
- information development and transfer
- diagnostic services

The program is associated with the development of an industry with significant commercial potential, and little competition from elsewhere. The Native Fruit Development Program is an important and unique contribution to the diversification of Saskatchewan's agricultural economy.

**The Workplan includes the following activities:**

- Germplasm Collection, Characterization, Cultivar Selection and Propagation
- Genetic Transformation of Saskatoons for Resistance to Entomosporium Leaf and Berry Spot Disease
- Breeding for Improved Native Fruit Cultivars
- Information and Communication

For more information on The Native Fruit Development Program: www.ag.usask.ca/departments/plsc/nfdp



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**Research**

**Animal Biotechnology**

This research program will cover the folowing four activity areas:

1. Manipulation of gastrointestinal function by dietary probiotivs and prebiotics to influence intestinal microflora, absorption of nutrients and disease resistance (new activity).
2. Stress control and prevention of the inhibitory effect of stress on general, non-specific disease resistance through the use of immunostimulants.
3. Enhancement of growth and carcass quality (a new activity to be developed).
4. Immunological approaches to control fertility to domestic animals (to be phased out).

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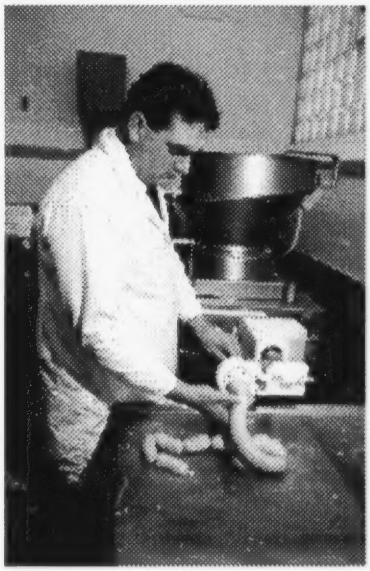
**Research**

**Value-Added (Meat)**



### Activity 96.1: Product and Process Development / Technology Transfer

The objectives are to:

1. develop products and processes that will enable the Saskatchewan meat processing sector to increase in size and scope.
2. evaluate new technologies and adapt them to the Saskatchewan environment.
3. provide opportunities for technology transfer (to the industry).

### Activity 96.2: Utilizing Saskatchewan-Based Ingredients in Meat Products (Ongoing)

The objective is to evaluate Saskatchewan based cereals, legumes or oilseed ingredients in low-fat processed meats.

### Activity 96.3: Utilizing Barley as an Ingredient in Comminuted Meat Products

The objective is to evaluate novel ingredients such as barley flour and barley bran fractions with varying beta-glucan content in low-fat processed meats. A secondary objective as an ingredient in low-fat beef burgers.

### Activity 96.4: Evaluation of Meat Flaking and Desinewing Technologies to add New Value to Beef and Game Meats

To evaluate effects of processing using flaking equipment, (eg Comitrol) and desinewing (eg Baader) on palatability of meat products.

### Activity 96.5: Studies to Improve the Eating Quality of Microwaveable, Marinated, Case Ready Pork

The objective is to evaluate ingredients and processing methods for their role in improving the palatablity (juiciness and tenderness) of microwaveable pork products from pork of varying quality.

### Activity 96.6: Meat microbiology

To utilize Linda Yu's meat microbiology expertise in the area of extended storage life of meat or rapid methods for the identification and enumeration of meat pathogens.



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**Research**

**Value-Added (Crops)**

## 2.1 Products from Pulses

The objectives are to develop novel food and food ingredients and prototype food products from pulses and develop novel processes and processing techniques applicable to pulses.

- 2.2.1 Processing, modification and utilization af small and very small granule starches.
- 2.2.2 Extraction, modification and utilization of barley starch
- 2.2.3 Physicochemical properties and pasting characteristics and film forming properties of pea and other higher amylose startches in the prescence of NaOH and/or borax.

### 2.3 Fuel Alcohol Production

In conjuction with Pound-Maker Agventures, to improve the economic returns from fuel alcohol production through the use of substrates other than wheat, pre-processing of substrates and very high gravity fermentations.

### 2.4 Studies on the Physicochemical Properties of High Palmitic Acid Vegetable Oils

To identify any commercially-valuable functionality of high palmitic acid solin and canola oils through physicochemical testing and bench-top crystallization studies on margarine blends.



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**Research**

## Agricultural Process Engineering

The strategic program in agricultural process engineering conducts fundamental research on design and analysis of value-added processes that utilize or produce materials of a biological nature. Since the program in Ag-process engineering was established in September 1993, research activities have been directed towards value-added processing technologies of commercial promise.

### Program Areas of Interest

***Heat and Mass Transfer Operations***
-development of mathematical models of temperature and moisture state in the materials, and relating these process parameters to the quality of the processed product.
-these models are used in the design, optimization and control of process and machinery to process food and feed.
***Rheological Properties of Materials***
-development of relationships between the mechanics and textural features of food and feed with emphasis on standard techniques/instrumentation for quality assessment and quality assurance: color, durability, chewiness and taste.
***Separation Technologies***
-developments of separation technologies on all forms of materials from whole seeds to extracts.
-separations are based on advanced textural imaging and associated recognition systems such as neural networks.
-more traditional methods such as mass and shape of components of mixtures.

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**Research**

**Food Animal Behaviour and Welfare**

**Activity I**

TITLE: Identify behavioural/physiological indicators of beef in cattle.
To determine if computer image analysis used to quantify the amount and velocity of head movements during branding can detect treatment differences between hot and freeze branded animals.

**Activity II**

TITLE: Factors that influence handling/temperature in beef cattle.
To determine if headgate modifications which reduce animal impact at the time of catching can reduce animal injury and improve subsequent handling-ease and welfare of beef cattle.

**Activity III**

TITLE:Studies of vocal communication in beef cattle.
To determine if

1. cattle produce characteristic vocalizations when subjected to a painful procedure (ie branding)
2. vocalizations made by cattle during a painful procedure evoke characteristic responses in animals hearing them
3. cows recognize their own calves by vocalizations

**Activity IV**

TITLE:The impact of the presence of adult cattle on calves during the weaning process.

To determine if

1. weaning calves in visual and auditory contact with cows is better than complete separation (traditional method) in terms of reducing stress
2. effect of the presence of a "trainer" cow

**Activity V**

TITLE:Prevalence and associated management factors of stereotypes in tethered heavy horses.
To determine if the incidence of stereotypies in tethered heavy horses versus other breeds under similiar conditions using on-farm 24 hour time budget analysis.

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**Research**

**Animal Disease Diagnosis**

Research and Development leading to

- availability of new diagnostic tests for livestock diseases
  -infectious diseases
  -non-infectious diseases
- special investigations of emerging diseases
- faculty from four WCVM departments
- strategic planning to set priorities

**Objectives**

1. To carry out research and development leading to new and improved diagnostic tests targeted at the most pressing needs of the livestock industry.
2. To carry out the implementation of new and improved diagnostic tests to a point at which they can be made available to the livestock industry through diagnostic laboratories.
3. To assist owners and veterinarians to investigate emerging new diseases and difficult diagnostic problems that occur within the livestock industry.



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**Research**

**Reproduction Efficiency and Welfare**

## ACTIVITY 1a

**Title:**
The effect of specific sperm defects on fertility.

**Objectives**

1. To study the effect of several forms of the knobbed acrosome defect on penetration and fertilization of in vitro matured packing plant ova.
2. To evaluate the ability of bulls that produce high percentages of the knobbed defect, to compete with normal bulls in leaving calves.
3. To study the ability of sperm with single apical nuclear vacuoles to penetrate the zona pellucida and support embryonic development.
4. To determine whether morphologically normal sperm, that are produced at the same time as sperm with an epididymal maturation defect (the distal midpiece reflex), are able to normally bind to, and penetrate ova.

## ACTIVITY 1b

**Title:**
The effect of season on bull semen quality.

**Objectives**

1. Use medical records to compare semen quality traits in bulls which have been presented for routine semen evaluation during different times of the year.
2. To collect and evaluate semen weekly from 5 normal bulls for a year to determine if there are seasonal fluctuations in semen quality. Repeat a second year with 5 different bulls.
3. Measure LH and Testosterone levels in blood of 5 bulls at the equinoxes and solstices to determine whether there are seasonal endocrine changes that can be related to semen quality. Repeat a second year in 5 different bulls.

## ACTIVITY 2

**Title:**
Alternative methods of semen collection.

**Objectives**

1. to continue to study modifications of a portable breeding crate and blind which protects the mount female the bull and allows the use of an artificial vagina for semen collection.
2. To determine the percentage of range bulls which would allow semen collection by artificial vagina.

## ACTIVITY 3

**Title:**
To develop methods to predict the time of puberty and fertility in the adult, based on hormone measurements and ultrasonography in the calf and to hasten puberty.

**Objectives**

a. To study the role of month of birth (season) on the pattern of hormone changes involved in reproductive maturation in bull and heifer calves and to use the expected differences in pattern to further show if hormone levels in young calves can be used as predictors of time to puberty and fertility.
2. To complete and summarize studies from year one.

**ACTIVITY 4**

**Title:**
Synchronization of estrus and ovulation for timed artificial inseminiation in beef cattle.

**Objectives**

1. To develop a simple cost effective hormone treatment that will allow precise control of the time of ovulation in cattle.
2. To determine if this treatment can be used effectively on the farm to synchronize ovulation in a large number of animals to facilitate time artificial insemination.

**ACTIVITY 5**

**Title:**
Gamete Recovery and Follicular Transfer.

**Objectives**

1. Determine loss rates of oocytes during manipulation and transfer procedures involved in GRAFT.
2. To compare the efficiency embryo production by conventional in vitro fertilization (IVF) and by GRAFT in cattle.
3. To compare the survival of the recipients own embryos and other cows' during the GRAFT procedure.

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**Administration**

## Workplans for 1997

Activity I: Database and Resource Material.

1. Maintain contact with the ICAR system and continue to work towards an Internet system. The Office of Reseach Services data base on work completed, projects funded and scientist capabliities will be maintained. Information from the database will be made avauilable upon request.
2. Data on the drect and indirect costs of agricultural research will be brought up to date as requested.
3. Information on other funding agencies and agricultural research institutions will be maintained and disseminated.

Activity II: Research Management.

1. Monitor the progress of activities under the Strategic Research Program and fund supported projects. Manage the development of proposals and the writing of reports to ensure that they are on time and meet the requirements of the funding agency.
2. Monitor the local and international scientific developments whaich can potentially enhance the effectiveness of research activities and incorporate these developments into research planning.
3. Monitor the needs of the agriculture and food industry for research needs that might be undertaken by University researchers.
4. Develop partnerships and innovative funding mechanisms in support of agricultural research.

Activity III: Communication

1. Arrange appropriate meetings between research administrators, scientists, Provincial staff and other agricultural organizations as required.
2. Develop and distribute written material on research potentials and research management to staff and board members of the Fund.

Activity IV: Research Administration

1. Develop contracts for the SRP and ADF Projects.
2. Provide advice on legal, institutional and contractual requirements of research projects and technology transfer activities.

Activity V: Technology Transfer

1. Ensure that the technology developed with the assistance of funding from the Fund is incorporated into University technology transfer activities.
2. Search commercial enterprises for opportunities for the utilization of agricultural technology developed in our research programs.



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